US011258892B2

(12) **United States Patent**
Wang et al.

(10) **Patent No.: US 11,258,892 B2**
(45) **Date of Patent: Feb. 22, 2022**

(54) **COMMUNICATION SIGNAL TRANSFORM DEVICE AND COMMUNICATION SIGNAL TRANSFORM METHOD**

(71) Applicants: **Li-Chuan Wang**, Taipei (TW); **Che-Wei Liang**, Taipei (TW); **Kun-Hsuan Chang**, Taipei (TW); **Sheng-Chieh Tang**, Taipei (TW); **Jung-Ming Hung**, Taipei (TW)

(72) Inventors: **Li-Chuan Wang**, Taipei (TW); **Che-Wei Liang**, Taipei (TW); **Kun-Hsuan Chang**, Taipei (TW); **Sheng-Chieh Tang**, Taipei (TW); **Jung-Ming Hung**, Taipei (TW)

(73) Assignee: **COMPAL ELECTRONICS, INC.**, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/417,662**

(22) Filed: **May 21, 2019**

(65) **Prior Publication Data**

US 2019/0373097 A1 Dec. 5, 2019

Related U.S. Application Data

(60) Provisional application No. 62/674,569, filed on May 21, 2018.

(51) **Int. Cl.**
H04M 1/725 (2021.01)
H04M 1/02 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04M 1/72409*** (2021.01); ***G06F 1/1626*** (2013.01); ***G06F 1/1632*** (2013.01); ***H04M 1/0283*** (2013.01)

(58) **Field of Classification Search**
CPC H04M 2203/1091; H04M 3/42229; H04M 3/42263; H04M 3/54; H04M 7/0069;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,167,097 B2 * 10/2015 Kung H04L 65/1026
9,276,628 B1 * 3/2016 Zommer H04B 1/3888
(Continued)

FOREIGN PATENT DOCUMENTS

CN	202856831	4/2013
TW	418331	12/2011
TW	201414263	4/2014

OTHER PUBLICATIONS

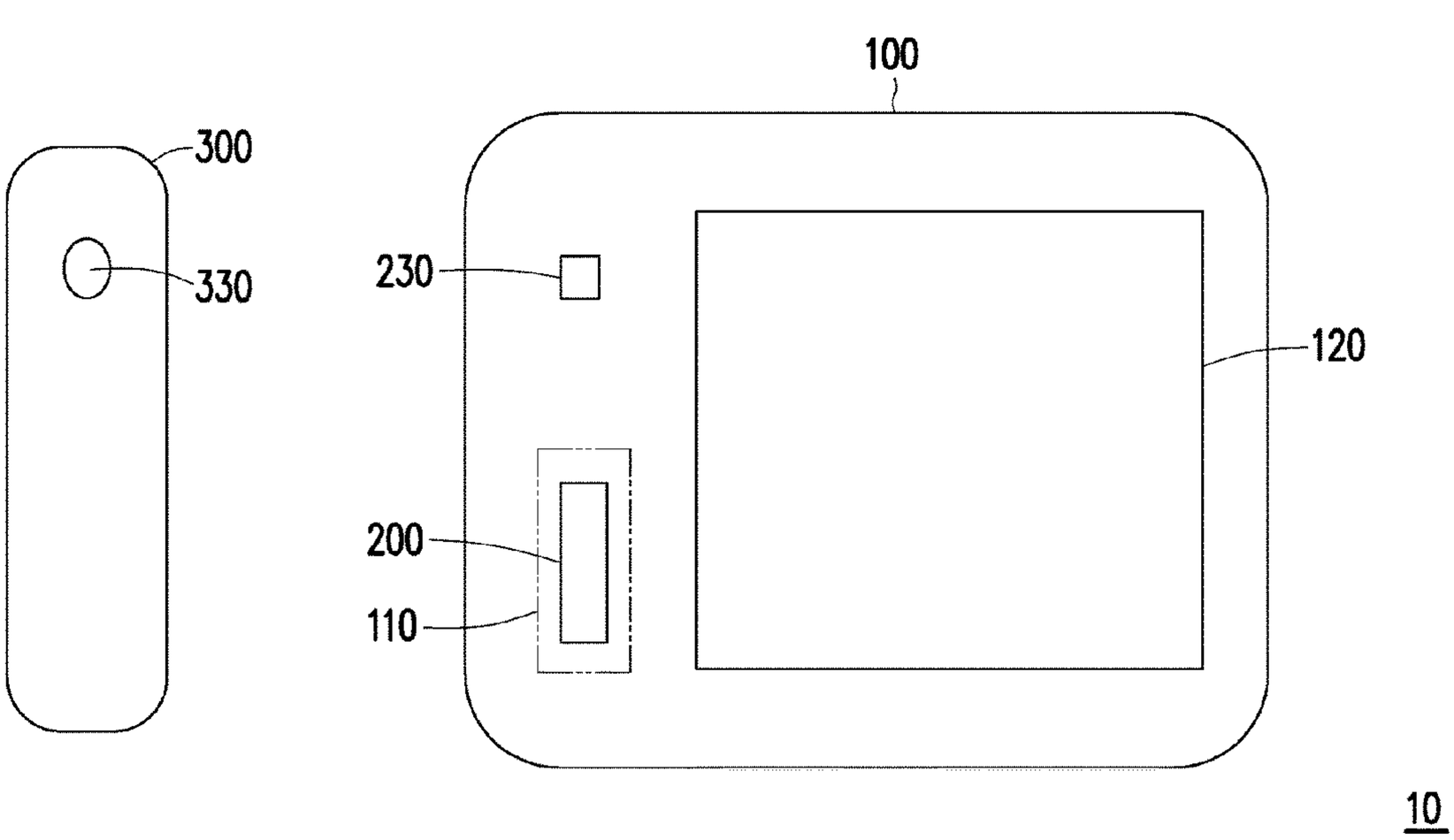
"Office Action of Taiwan Counterpart Application", dated Mar. 5, 2020, p. 1-p. 8.

Primary Examiner — Liton Miah
(74) *Attorney, Agent, or Firm* — JCIPRNET

(57) **ABSTRACT**

A communication signal transform device and a communication signal transform method are provided. The communication signal transform method includes: disposing the mobile device detachably in a case having an exposed portion, and exposing a display of the mobile device from the case through the exposed portion; and generating an output signal supported by the mobile device in response to a signal received from an external telephone line, and transmitting the output signal to the mobile device.

17 Claims, 6 Drawing Sheets



(51) **Int. Cl.**
G06F 1/16 (2006.01)
H04M 1/72409 (2021.01)

(58) **Field of Classification Search**
CPC H04M 1/725; H04M 2207/203; H04M 1/6016; H04M 1/72; H04W 76/10; H04W 84/14; H04W 88/02
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,571,148	B2 *	2/2017	Olson	G08C 17/02
2003/0078948	A1 *	4/2003	Otsuka	G06F 11/1456
2006/0111151	A1 *	5/2006	Lie	H04M 1/72 455/565
2014/0128131	A1 *	5/2014	Sin	H04B 1/3888 455/575.8
2015/0065208	A1 *	3/2015	Balaji	A45C 11/00 455/575.8
2018/0241868	A1 *	8/2018	Mahalingam	H04M 1/72527

* cited by examiner

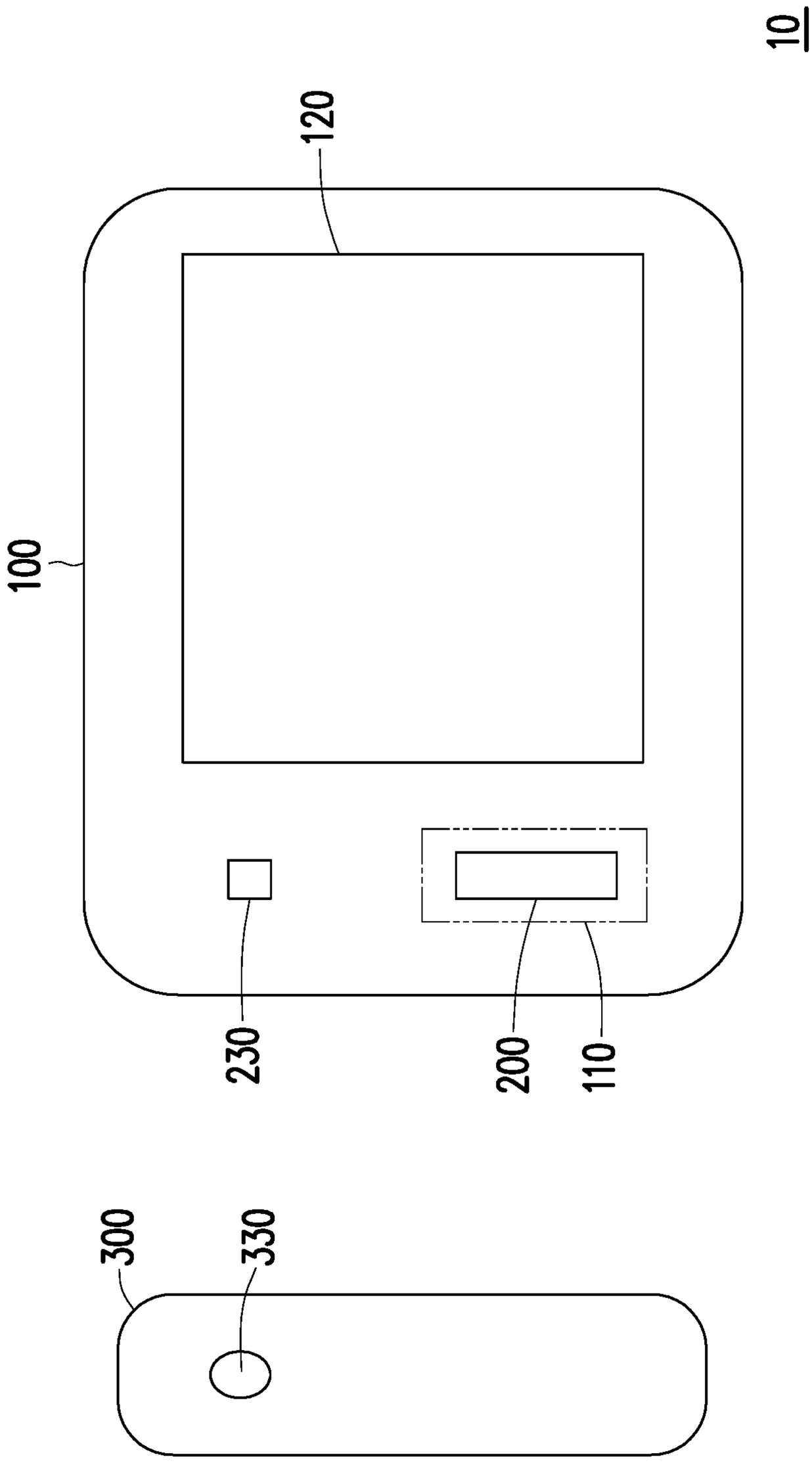


FIG. 1

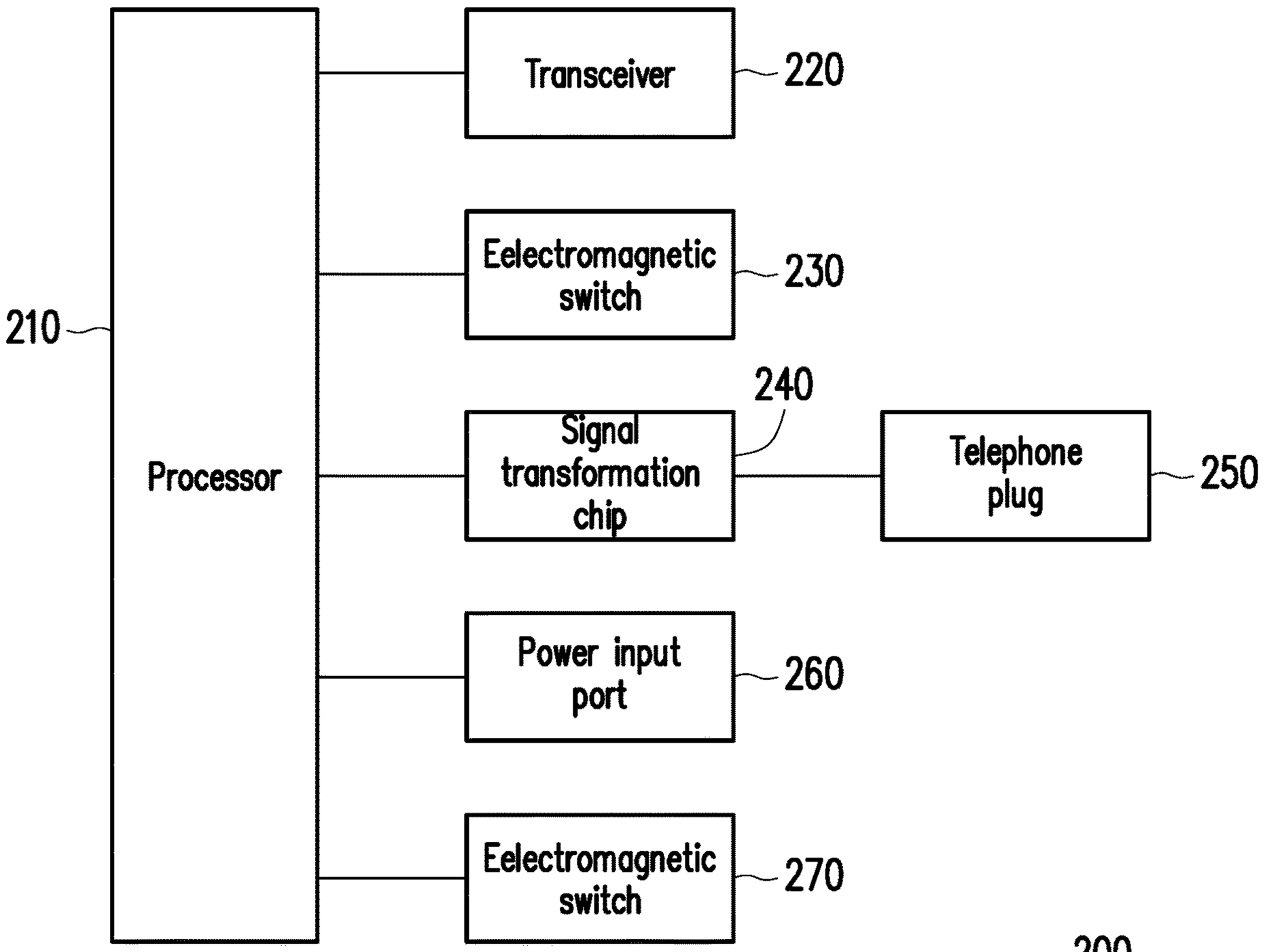

Transceiver
220
Eelectromagnetic switch
230
210
240
Signal transformation chip
Telephone plug
250
Processor
Power input port
260
Eelectromagnetic switch
270
200

FIG. 2

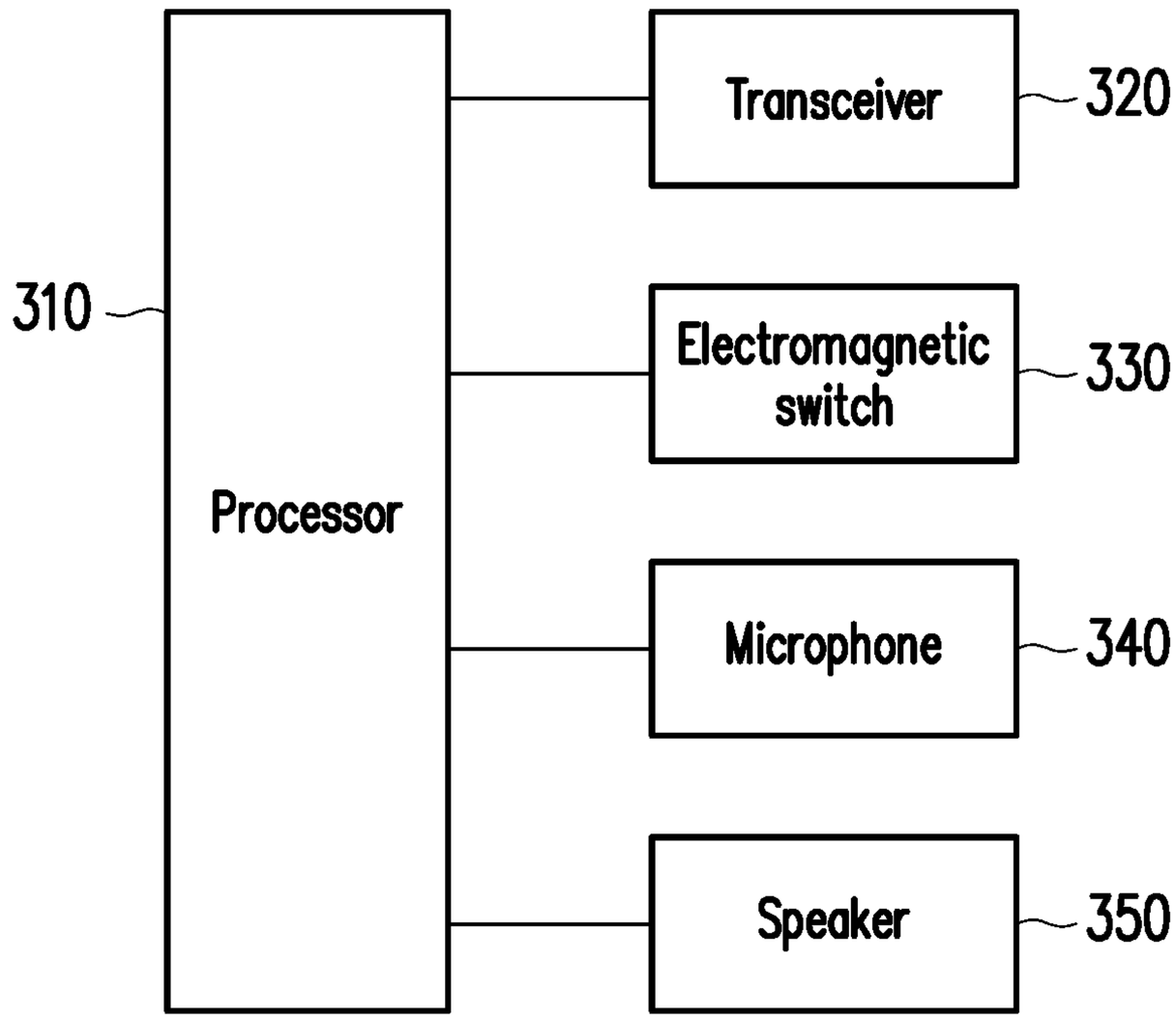

310
Processor
Transceiver
320
Electromagnetic switch
330
Microphone
340
Speaker
350
300

FIG. 3A

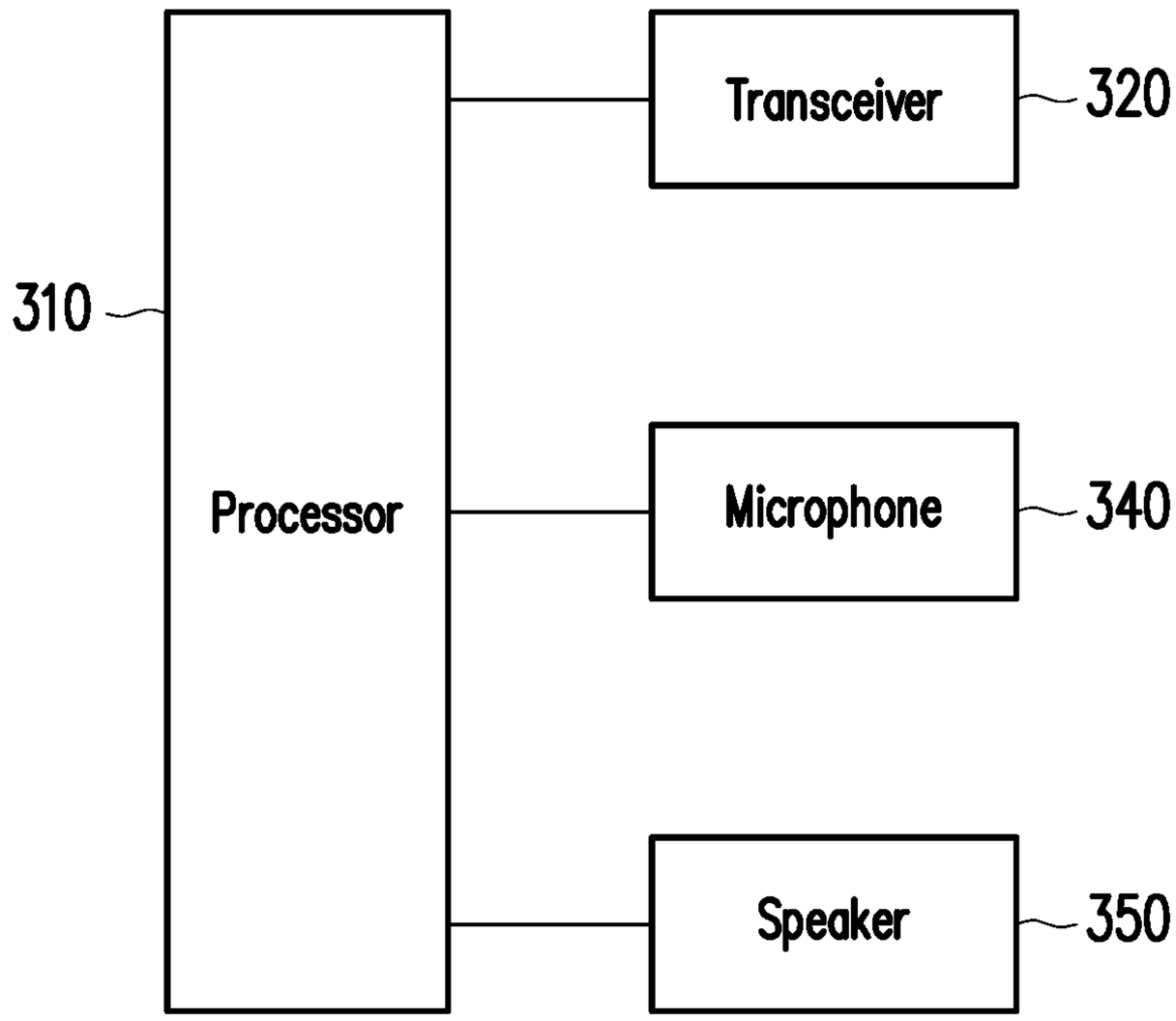

310
Processor
Transceiver
320
Microphone
340
Speaker
350
100

FIG. 3B

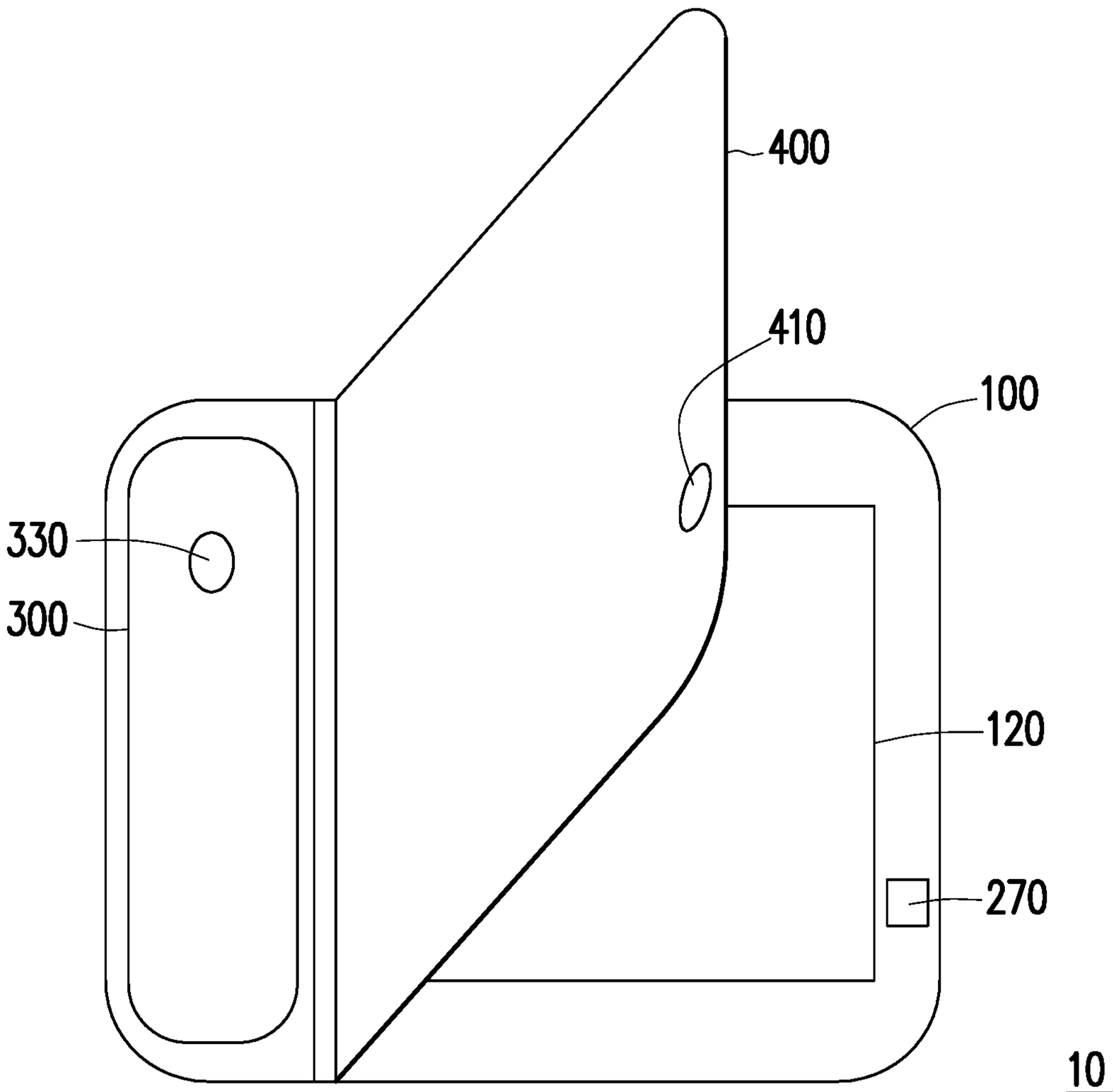


FIG. 4

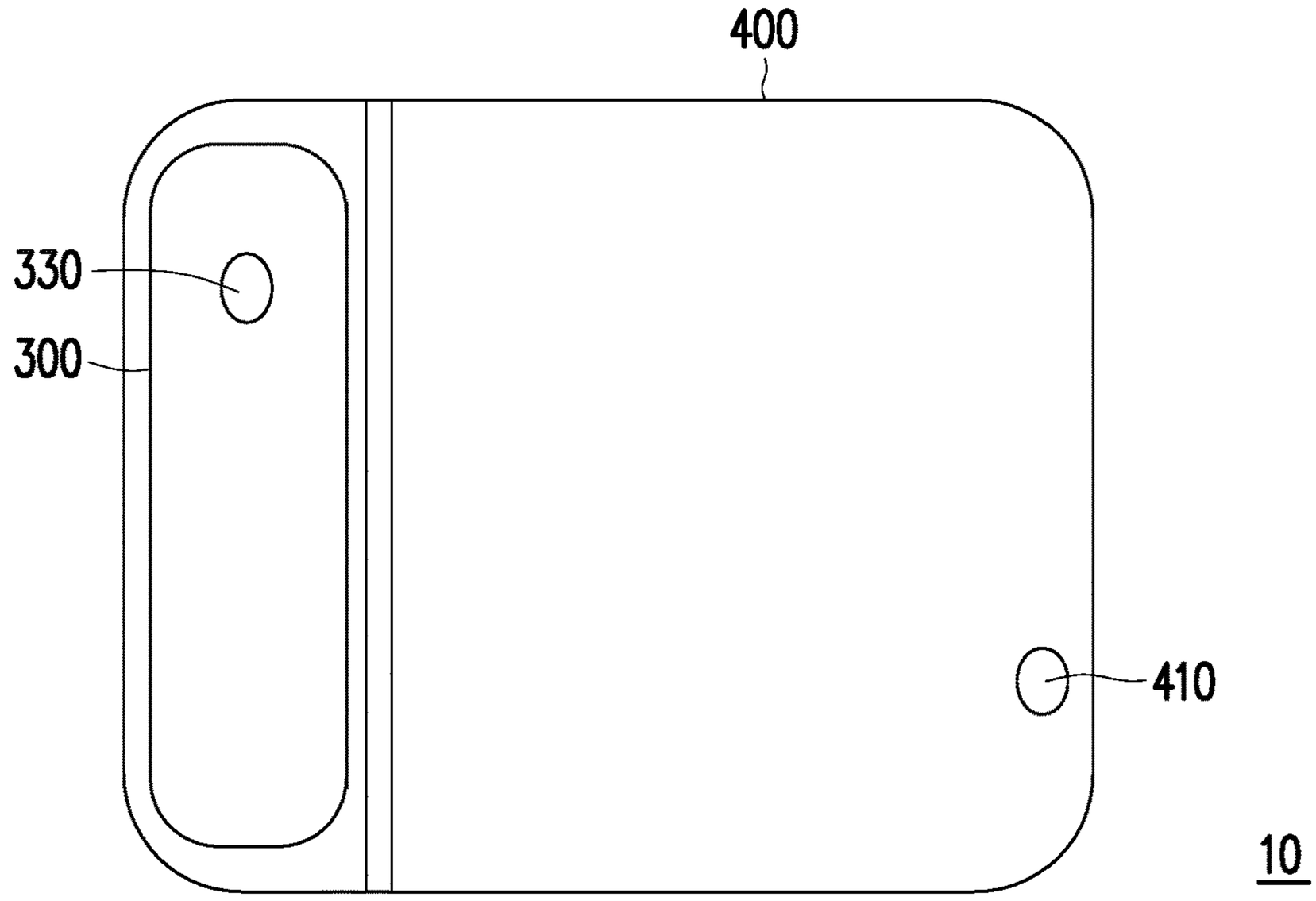


FIG. 5

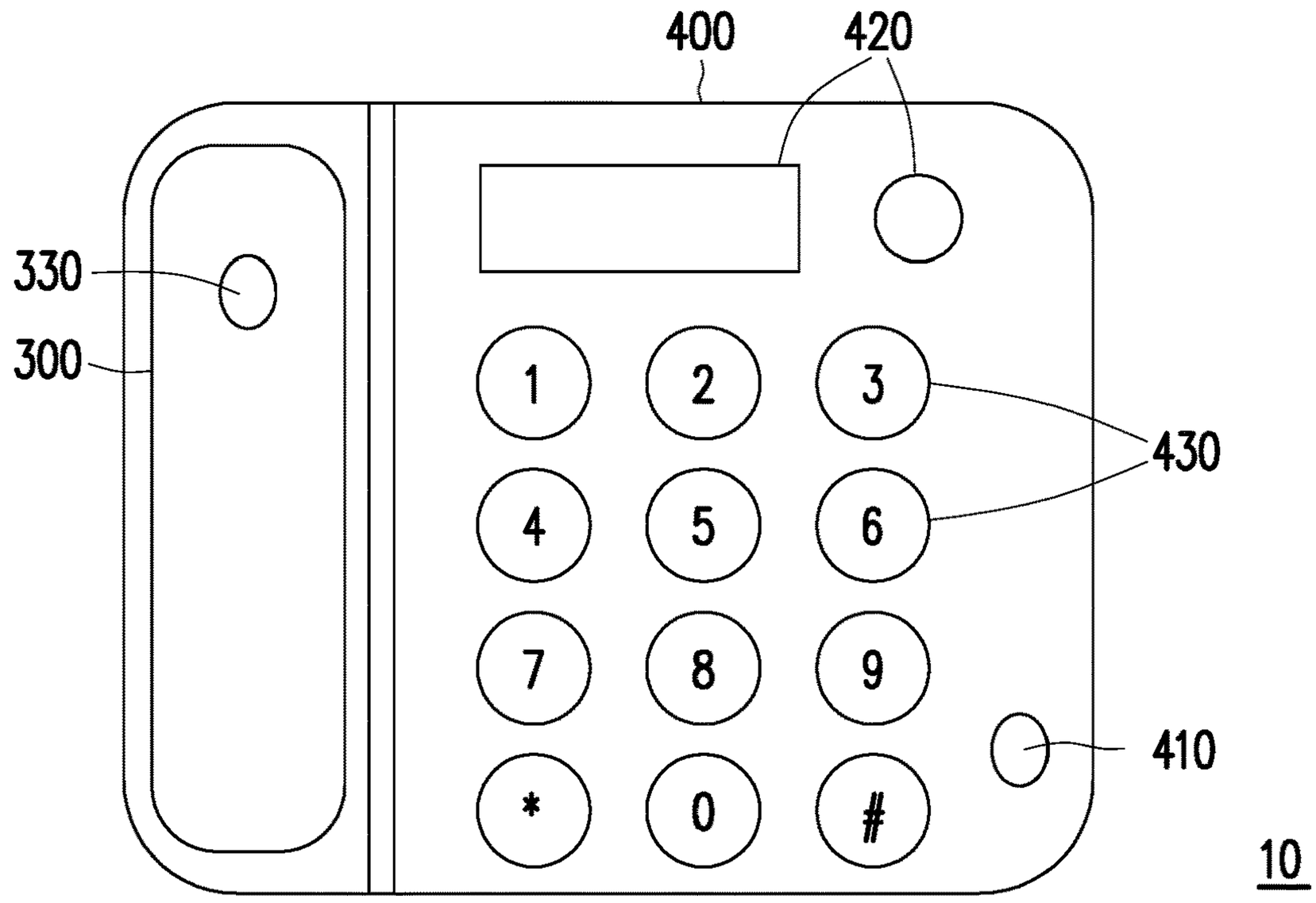


FIG. 6

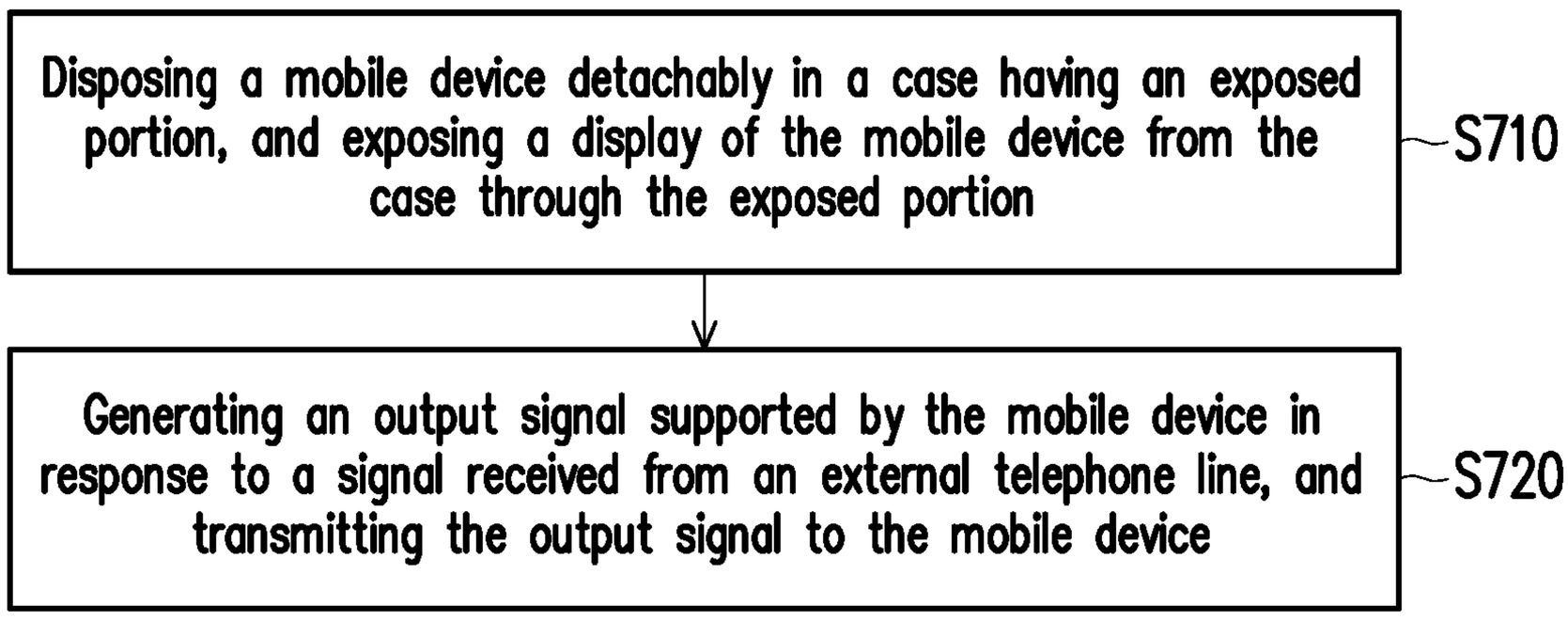

Disposing a mobile device detachably in a case having an exposed portion, and exposing a display of the mobile device from the case through the exposed portion
S710
Generating an output signal supported by the mobile device in response to a signal received from an external telephone line, and transmitting the output signal to the mobile device
S720

FIG. 7

COMMUNICATION SIGNAL TRANSFORM DEVICE AND COMMUNICATION SIGNAL TRANSFORM METHOD

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefits of U.S. provisional application Ser. No. 62/674,569, filed on May 21, 2018. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of specification.

TECHNICAL FIELD

The invention relates to a communication signal transform device and a communication signal transform method.

BACKGROUND

With advancements in technologies, mobile devices such as mobile phones or tablets computer have been commonly used. The number of indoor landline telephones is gradually decreasing as almost everyone holds a mobile phone nowadays. Moreover, many homes no longer have the landline telephones installed. However, the landline telephones still have many advantages that cannot be replaced by the existing mobile phones. For instance, the call cost of the landline telephone is much lower than that of the mobile phone.

On the other hand, due to the increasingly fierce market competition, the product life cycle of the mobile devices is getting shorter. Users who frequently change the mobile devices often have many mobile devices that are not yet damaged but are idle.

SUMMARY

Accordingly, the invention provides a communication signal transform device and a communication signal transform method, which are adapted for transforming a mobile device into a landline telephone.

The communication signal transform device of the invention includes a case and a motherboard. The case is configured to accommodate a mobile device such that the mobile device is detachably disposed in a case having an exposed portion and a display of the mobile device is exposed from the case through the exposed portion. The motherboard includes a telephone plug, a first transceiver, a first processor and a signal transformation chip. The telephone plug is configured to be coupled to an external telephone line. The first transceiver is communicatively coupled to the mobile device. The first processor is coupled to the first transceiver. The signal transformation chip is coupled to the first processor and the telephone plug, and the signal transformation chip generates an output signal supported by the mobile device in response to a signal received from the external telephone line. The first processor transmits the output signal to the mobile device through the first transceiver.

In an embodiment of the invention, the signal transformation chip transforms an input signal from the mobile device into a dual tone multi frequency output signal to transmit the dual tone multi frequency output signal to the external telephone line, and transforms the signal from the external telephone line into the output signal to transmit the output signal to the mobile device. The output signal is one of a digital voice signal and a control command.

In an embodiment of the invention, the communication signal transform device further includes a telephone handset. The telephone handset includes a second transceiver, a microphone, a speaker and a second processor. The second transceiver is communicatively coupled to the first transceiver. The microphone receives a first voice signal. The speaker plays a second voice signal. The second processor is coupled to the second transceiver, the microphone and the speaker. The second processor transmits the first voice signal to the first transceiver through the second transceiver, and receives the second voice signal from the first transceiver through the second transceiver.

In an embodiment of the invention, a first electromagnetic switch is disposed on the case. The first electromagnetic switch is coupled to the first processor; the second electromagnetic switch is disposed on a housing of the telephone handset; and the first processor determines that the telephone handset is on-hook in response to the first magnetic switch magnetically coupled to the second magnetic switch, and the first processor determines that the telephone handset is off-hook in response to the first magnetic switch not magnetically coupled to the second magnetic switch.

In an embodiment of the invention, the first processor instructs the mobile device through the first transceiver to execute at least one of starting up, displaying a dial pad, displaying an address book, and displaying a web browser page in response to determining that the telephone handset is off-hook.

In an embodiment of the invention, the first processor instructs the mobile device through the first transceiver to enter a standby mode in response to determining that the telephone handset is on-hook.

In an embodiment of the invention, the communication signal transform device further includes: a third electromagnetic switch, disposed on the case and coupled to the first processor; and a cover, connected to the case and disposed with a fourth electromagnetic switch. The first processor determines that the cover covers on the exposed portion in response to the third magnetic switch magnetically coupled to the fourth magnetic switch, and the first processor determines that the cover is opened in response to the third magnetic switch not magnetically coupled to the fourth magnetic switch.

In an embodiment of the invention, the first processor instructs the mobile device through the first transceiver to execute at least one of starting up, displaying a dial pad, executing a memo application, executing a photo album application, displaying an address book, displaying a news page, and displaying a web browser page in response to determining that the cover is opened.

In an embodiment of the invention, a plurality of holes is disposed on the cover such that the cover exposes a portion of the display of the mobile device when covering on the exposed portion.

In an embodiment of the invention, the first processor instructs the mobile device through the first transceiver to display a dial pad in response to determining that the cover covers on the exposed portion. Numbers and symbols on the dial pad are exposed through the holes on the cover.

In an embodiment of the invention, the control command instructs the mobile device to display a call ID corresponding to the signal.

In an embodiment of the invention, the case further includes: a second transceiver, communicatively coupled to the first transceiver; a microphone, receiving a first voice signal; a speaker, playing a second voice signal; and a second processor, coupled to the second transceiver, the

microphone and the speaker. The second processor transmits the first voice signal to the first transceiver through the second transceiver, and receives the second voice signal from the first transceiver through the second transceiver.

The communication signal transform method of the invention includes: disposing the mobile device detachably in a case having an exposed portion, and exposing a display of the mobile device from the case through the exposed portion; and generating an output signal supported by the mobile device in response to a signal received from an external telephone line, and transmitting the output signal to the mobile device.

In an embodiment of the invention, the communication signal transform method further includes: transforming an input signal from the mobile device into a dual tone multi frequency output signal to transmit the dual tone multi frequency output signal to the external telephone line; and transforming the signal from the external telephone line into the output signal to transmit the output signal to the mobile device, wherein the output signal is one of a digital voice signal and a control command.

In an embodiment of the invention, a first electromagnetic switch is disposed on the case, and a second electromagnetic switch is disposed on a housing of a telephone handset that fits the case, wherein the communication signal transform method further includes: determining that the telephone handset is on-hook in response to the first magnetic switch magnetically coupled to the second magnetic switch; and determining that the telephone handset is off-hook in response to the first magnetic switch not magnetically coupled to the second magnetic switch.

In an embodiment of the invention, the communication signal transform method further includes: instructing the mobile device to execute at least one of starting up, displaying a dial pad, displaying an address book, and displaying a web browser page in response to determining that the telephone handset is off-hook.

In an embodiment of the invention, the communication signal transform method further includes: instructing the mobile device to enter a standby mode in response to determining that the telephone handset is on-hook.

In an embodiment of the invention, the communication signal transform method further includes: disposing a third electromagnetic switch on the case; connecting a cover disposed with a fourth magnetic switch to the case; determining that the cover covers on the exposed portion in response to the third magnetic switch magnetically coupled to the fourth magnetic switch; and determining that the cover is opened in response to the third magnetic switch not magnetically coupled to the fourth magnetic switch.

In an embodiment of the invention, the communication signal transform method further includes: instructing the mobile device to execute at least one of starting up, displaying a dial pad, executing a memo application, executing a photo album application, displaying an address book, displaying a news page, and displaying a web browser page in response to determining that the cover is opened.

In an embodiment of the invention, the communication signal transform method further includes: disposing a plurality of holes on the cover such that the cover exposes a portion of the display of the mobile device when covering on the exposed portion.

In an embodiment of the invention, the communication signal transform method further includes: instructing the mobile device to display a dial pad in response to determining that the cover covers the exposed portion, wherein numbers and symbols on the dial pad are exposed through the holes on the cover.

In an embodiment of the invention, the control command instructs the mobile device to display a call ID corresponding to the signal.

In an embodiment of the invention, the communication signal transform method further includes: receiving a first voice signal by using a microphone on the case; transforming the first voice signal into a dual tone multi frequency output signal, and transmitting the dual tone multi frequency output signal to the external telephone line; transforming the signal from the external telephone line into a second voice signal, wherein the signal is a dual tone multi frequency input signal; and playing the second voice signal by using a speaker on the case.

Based on the above, the communication signal transform device of the invention can transform the idle mobile device into the landline phone so that the idle mobile device may be reused effectively.

To make the above features and advantages of the disclosure more comprehensible, several embodiments accompanied with drawings are described in detail as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a schematic diagram of a communication signal transform device according to an embodiment of the invention.

FIG. **2** illustrates a function block diagram of the motherboard of the communication signal transform device according to an embodiment of the invention.

FIG. **3**A illustrates a function block diagram of the telephone handset of the communication signal transform device according to an embodiment of the invention.

FIG. **3**B illustrates a function block diagram of the modified case of the telephone handset according to an embodiment of the invention.

FIG. **4** illustrates a schematic diagram of the communication signal transform device with a cover opened according to an embodiment of the invention.

FIG. **5** illustrates a schematic diagram of the communication signal transform device with the cover covering on the exposed portion of the case according to an embodiment of the invention.

FIG. **6** illustrates a schematic diagram of the communication signal transform device with the cover having a plurality of holes according to an embodiment of the invention.

FIG. **7** illustrates a schematic diagram of a communication signal transform method according to an embodiment of the invention.

DETAILED DESCRIPTION

In order to make content of the invention more comprehensible, embodiments are described below as the examples to prove that the invention can actually be realized. Moreover, elements/components/steps with same reference numerals represent same or similar parts in the drawings and embodiments.

FIG. **1** illustrates a schematic diagram of a communication signal transform device **10** according to an embodiment of the invention. The communication signal transform device **10** can execute functions such as transforming a mobile device into a landline telephone. Here, the mobile device is, for example, an electronic device having a display,

such as a smart phone or a tablet computer. In the following embodiment, the display of the mobile device is a touch display, but the invention is not limited thereto.

With reference to FIG. **1**, the communication signal transform device **10** includes a case **100** and a motherboard **200**. The case **100** includes a preset space **110** and an exposed portion **120**. The motherboard **200** may be disposed in the preset space **110** of the case **100**, but the invention is not limited thereto. When the mobile device is detachably disposed in the case **100**, the display of the mobile device is exposed from the case **100** through the exposed portion **120**. Since the display of the mobile device is the touch display, the user can touch on the touch display of the mobile device through the exposed portion **120** to operate the mobile device disposed in the case **100**. The motherboard **200** is, for example, a printed circuit board (PCB).

FIG. **2** illustrates a function block diagram of the motherboard **200** of the communication signal transform device **10** according to an embodiment of the invention. With reference to FIG. **2**, the motherboard **200** includes a processor **210**, a transceiver **220**, a signal transformation chip **240**, a telephone plug **250** and a power input port **260**. The processor **210** is configured to implement functions of the communication signal transform device **10**. The processor **210** is, for example, a central processing unit (CPU) or other programmable micro control units (MCU) for general purpose or special purpose such as a microprocessor, a digital signal processor (DSP), a programmable controller, an application specific integrated circuit (ASIC), a graphics processing unit (GPU), an arithmetic logic unit (ALU), other similar elements or a combination of above-mentioned elements, but the invention is not limited thereto.

The transceiver **220** is coupled to the processor **210**. The transceiver **220** is configured to be communicatively coupled to the mobile device disposed in the case **100** by using one of a plurality of communication protocols. Here, the communication protocols include Bluetooth or Wi-Fi, but the invention is not limited thereto. For instance, the transceiver **220** may also be connected to the mobile device through physical lines and communicated with the mobile device by using communication protocols such as universal serial bus (USB) or lightning.

The signal transformation chip **240** is coupled to the processor **210** and the telephone plug **250**. Here, the telephone plug **250** is configured to couple to an external telephone line. The signal transformation chip **240** generates an output signal supported by the mobile device in response to a signal received from the external telephone line. The processor **210** can transmit the output signal to the mobile device through the transceiver **220**. For instance, the signal transformation chip **240** can transform an analog voice signal from the external telephone line into a digital voice signal. The processor **210** can transmit the digital voice signal to the mobile device through the transceiver **220** so the mobile device can communicate with an external telephone on the other side the external telephone line through the external telephone line. As another example, the signal transformation chip **240** can transform the signal from the external telephone line into a control command. The processor **210** can transmit the control command to the mobile device through the transceiver **220** to instruct the mobile device to display a call ID corresponding to the signal from the external telephone line.

On the other hand, the processor **210** can receive an input signal from the mobile device through the transceiver **220**. The signal transformation chip **240** can transform the input signal from the mobile device into a dual tone multi frequency output signal to transmit the dual tone multi frequency output signal to the external telephone line coupled to the telephone plug **250**. Here, the input signal is a digital signal that can be supported by the mobile device (e.g., a dial signal generated by the mobile device), and the dual tone multi frequency output signal is an analog signal that can be supported by the traditional landline telephone. With reference to FIG. **1**, in certain embodiments, the communication signal transform device **10** further includes a telephone handset **300**. FIG. **3**A illustrates a function block diagram of the telephone handset **300** of the communication signal transform device **10** according to an embodiment of the invention. With reference to FIG. **3**A, the motherboard **300** includes a processor **310**, a transceiver **320**, an electromagnetic switch **330**, a microphone **340** and a speaker **350**.

The processor **310** is coupled to the transceiver **320**, the microphone **340** and the speaker **320**. The transceiver **320** is configured to be communicatively coupled to the transceiver **220**. The processor **310** is configured to implement functions of the telephone handset **300** of the communication signal transform device **10**. Specifically, when the processor **310** is communicatively coupled to the transceiver **220** through the transceiver **320**, voice signals can be transmitted between the processor **310** and the processor **210**. For instance, the microphone **340** can receive a first voice signal. Here, the first voice signal is, for example, a sound made by the user. The processor **310** can transmit the first voice signal to the transceiver **220** through the transceiver **320**. The first voice signal is transmitted to the external telephone line via the signal transformation chip **240**.

On the other hand, after the signal transformation chip **240** receives a second voice signal from the external telephone line through the telephone plug, the signal transformation chip **240** can forward the second voice signal to the processor **210**. The processor **210** can transmit the second voice signal to the telephone handset **300** through the transceiver **220**. The telephone handset **300** can play the second voice signal through the speaker **350**.

In certain embodiments, the processor **310** is coupled to the electromagnetic switch **330**. The processor **310** can determine whether the telephone handset **300** is on-hook or off-hook according to whether the electromagnetic switch **330** is magnetically coupled to the other electromagnetic switch. The processor **310** enters a standby mode in response to the electromagnetic switch **330** magnetically coupled to magnetically coupled to the other electromagnetic switch, and starts up in response to the electromagnetic switch **330** not magnetically coupled to the other electromagnetic switch.

The processor **310** is, for example, a central processing unit or other programmable micro control units for general purpose or special purpose such as a microprocessor, a digital signal processor, a programmable controller, an application specific integrated circuit, a graphics processing unit, an arithmetic logic unit, other similar elements or a combination of above-mentioned elements, but the invention is not limited thereto.

The transceiver **320** is coupled to the processor **310**. The transceiver **320** is configured to be communicatively coupled to the transceiver **220** by using one of a plurality of communication protocols. Here, the communication protocols include Bluetooth or Wi-Fi, but the invention is not limited thereto. For instance, the transceiver **320** may also be connected to the transceiver **220** through physical lines and communicated with the transceiver **220** by using communication protocols such as universal serial bus or lightning.

Table 1 is a lookup table for transformation between a digital signal and a dual tone multi frequency signal. The signal transformation chip **240** can store the lookup table and transform the input signal (e.g., the dial signal) from the mobile device into the dual tone multi frequency output signal according to the lookup table. For instance, after the signal transformation chip **240** receives a digital signal "0001" representing "the number 1" from the mobile device, the signal transformation chip **240** can transform the digital signal "0001" representing "the number 1" into a dual tone multi frequency output signal with low frequency "697 Hz" and high frequency "1209 Hz", and then transmit said dual tone multi frequency output signal to the external telephone line through the telephone plug **250**. A telephone switch on the other side of the external telephone line can receive the dual tone multi frequency output signal and determine that the number dialed by the user from the mobile device is "the number 1" according to the dual tone multi frequency output signal.

TABLE 1

Numbers and symbols	Digital signal Bit 3	Bit 2	Bit 1	Bit 0	Dual tone multi frequency signal: Low frequency (Hz)	High frequency (Hz)
1	0	0	0	1	697	1209
2	0	0	1	0	697	1336
3	0	0	1	1	697	1477
4	0	1	0	0	770	1209
5	0	1	0	1	770	1336
6	0	1	1	0	770	1477
7	0	1	1	1	852	1209
8	1	0	0	0	852	1336
9	1	0	0	1	852	1477
0	1	0	1	0	941	1336
*	1	0	1	1	941	1209
#	1	1	0	0	941	1477

The power input port **260** is coupled to a power source. The power input port **260** is configured to supply the communication signal transform device **10** electric energy. In certain embodiments, the communication signal transform device **10** can supply electric energy to the mobile device disposed in the case **100** in a wired or wireless manner.

In certain embodiments, it also possible that the communication signal transform device **10** does not include telephone handset **300**. Functions of the telephone handset **300** may be replaced by the case **100** being modified. FIG. **3**B illustrates a function block diagram of the modified case **100** of the telephone handset according to an embodiment of the invention. The modified case **100** may include the processor **310** as well as the transceiver **320**, the microphone **340** and the speaker **350** coupled to the processor **310**.

With reference to FIG. **1** and FIG. **3**A, in certain embodiments, an electromagnetic switch **230** coupled to the processor **210** is disposed on the case **100**. The telephone handset **300** can be fixed onto the case **100** by magnetically coupling the electromagnetic switch **330** to the electromagnetic switch **230**. The processor **210** can determine whether the telephone handset **300** is on-hook or off-hook according to whether the electromagnetic switch **230** and the electromagnetic switch **330** are magnetically coupled. Specifically, the processor **210** determines that the telephone handset **300** is on-hook in response to the electromagnetic switch **230** magnetically coupled to the electromagnetic switch **330**, and the processor **210** determines that the telephone handset **300** is off-hook in response to the electromagnetic switch **230** not magnetically coupled to the electromagnetic switch **330**.

The processor **210** can instruct the mobile device disposed in the case **100** through the transceiver **220** to execute multiple functions in response to the telephone handset **300** being off-hook. For instance, the processor **210** can instruct the mobile device in the standby mode or a sleep mode to start up or wake up after determining that the telephone handset **300** is off-hook. On the other hand, the processor **210** can instruct the mobile device to enter the standby mode or the sleep mode after determining that the telephone handset **300** is on-hook so as to save energy.

In certain embodiments, the processor **220** can determine that the user is about to make a phone call in response to the telephone handset **300** being off-hook. In such case, the processor **210** can instruct the mobile device through the transceiver **220** to display a dial pad on the display for the user to dial a telephone number. The processor **210** can also instruct the mobile device through the transceiver **220** to display an address book so the user can dial the telephone number more conveniently. Optionally, contact's avatars may be used on the address book. The address book can be combined with the functionality of an album application. For instance, the user can use photos in the album application to set the contact's avatars on the address book.

In certain embodiments, the processor **210** can instruct the mobile device through the transceiver **220** to display a web browser page in response to the telephone handset **300** being off-hook. The mobile device can automatically dial the telephone number in response to the telephone number on the web browser page being tapped by the user.

FIG. **4** illustrates a schematic diagram of the communication signal transform device **10** with a cover **400** opened according to an embodiment of the invention. FIG. **5** illustrates a schematic diagram of the communication signal transform device **10** with the cover **400** covering on the exposed portion **120** of the case **100** according to an embodiment of the invention. With reference to FIG. **4** and FIG. **5**, in certain embodiments, the communication signal transform device **10** further includes the cover **400**, and an electromagnetic switch **270** coupled to the processor **210** is disposed on the case **100** (as shown by FIG. **2**). The cover **400** is connected to the case **100** and disposed with an electromagnetic switch **410**. The processor **210** can determine whether the cover **400** is opened according to whether the electromagnetic switch **270** and the electromagnetic switch **410** are magnetically coupled. Specifically, the processor **210** determines that the cover **4000** covers on the exposed portion **120** of the exposed portion **120** of the case **100** in response to the electromagnetic switch **270** magnetically coupled to the electromagnetic switch **410**, as shown by FIG. **5**. On the other hand, the processor **210** determines that the cover **400** is opened in response to the electromagnetic switch **270** not magnetically coupled to the electromagnetic switch **410**, as shown by FIG. **4**.

The processor **210** can instruct the mobile device disposed in the case **100** through the transceiver **220** to execute multiple functions in response to determining that the cover **400** is opened. For instance, the processor **210** can instruct the mobile device through the transceiver **220** to start up and display the dial pad after determining that the cover **400** is opened. As another example, the processor **210** can instruct the mobile device through the transceiver **220** to execute a memo application for the user to record the conversation after determining that the cover **400** is opened Alternatively,

the processor **210** can instruct the mobile device through the transceiver **220** to display a news page after determining that the cover **400** is opened.

In certain embodiments, the processor **210** can instruct the mobile device through the transceiver **220** to display an address book in response to the cover **400** being opened so the user can dial the telephone number more conveniently. Optionally, contact's avatars may be used on the address book. The address book can be combined with the functionality of an album application. For instance, the user can use photos in the album application to set the contact's avatars on the address book.

In certain embodiments, the processor **210** can instruct the mobile device through the transceiver **220** to display a web browser page in response to the cover **400** being opened. The mobile device can automatically dial the telephone number in response to the telephone number on the web browser page being tapped by the user.

FIG. **6** illustrates a schematic diagram of the communication signal transform device **10** with the cover **400** having a plurality of holes **420** and **430** according to an embodiment of the invention. With reference to FIG. **6**, in certain embodiments, the holes **420** or **430** are disposed on the cover **400**. When the cover **400** covers on the exposed portion **120** of the case **100**, the mobile device disposed in the case **100** can expose a portion of the display from the case **100** through the holes **420** or the holes **430**. Accordingly, images in the portion of the display may be exposed through the holes **420** or the holes **430**. Here, the images include, for example, the dial pad, the address book, the contact or functions buttons on the landline telephone (e.g., a redial button, a missed-call-inquiry button, a speaker button, a hold button or a transfer button, but the invention is not limited thereto). For instance, the processor **210** can instruct the mobile device through the transceiver **220** to display the dial pad in response to determining that the cover **400** covers on the exposed portion **120**. Here, numbers and symbols on the dial pad are exposed through the holes **430** on the cover **400**. The user can dial the telephone number by touching the dial pad displayed by the mobile device through the holes **430**.

FIG. **7** illustrates a schematic diagram of a communication signal transform method according to an embodiment of the invention. The communication signal transform method is adapted for transforming a mobile device into a landline telephone, and the communication signal transform method may be implemented by the communication signal transform device **10**. In step S**710**, the mobile device is detachably disposed in a case having an exposed portion, and a display of the mobile device is exposed from the case through the exposed portion. In step S**720**, an output signal supported by the mobile device is generated in response to a signal received from an external telephone line, and the output signal is transmitted to the mobile device.

In summary, the communication signal transform device of the invention can transform the idle mobile device into the landline phone. Simply by disposing the mobile device in the communication signal transform device, the communication signal transform device can generate the dial pad by using the display of the mobile device and allow the telephone handset to be communicatively coupled to the mobile device. In this way, the user can achieve a user experience similar to that of using the landline telephone through the telephone handset and the dial pad. On other hand, the mobile device connected with the communication signal transform device can provide more functions than the functions of the traditional landline telephone, and the idle mobile phone may be reused effectively.

No element, act, or instruction used in the detailed description of disclosed embodiments of the invention should be construed as absolutely critical or essential to the present disclosure unless explicitly described as such. Also, as used herein, each of the indefinite articles "a" and "an" could include more than one item. If only one item is intended, the terms "a single" or similar languages would be used. Furthermore, the terms "any of" followed by a listing of a plurality of items and/or a plurality of categories of items, as used herein, are intended to include "any of", "any combination of", "any multiple of", and/or "any combination of multiples of the items and/or the categories of items", individually or in conjunction with other items and/or other categories of items. Further, as used herein, the term "set" is intended to include any number of items, including zero. Further, as used herein, the term "number" is intended to include any number, including zero.

Although the present disclosure has been described with reference to the above embodiments, it will be apparent to one of ordinary skill in the art that modifications to the described embodiments may be made without departing from the spirit of the disclosure. Accordingly, the scope of the disclosure will be defined by the attached claims and not by the above detailed descriptions.

The invention claimed is:

1. A communication signal transform device, comprising:

a case, configured to accommodate a mobile device such that the mobile device is detachably disposed in a case having an exposed portion and a display of the mobile device is exposed from the case through the exposed portion;

a motherboard, the motherboard comprising:

a telephone plug, configured to be coupled to an external telephone line;

a first transceiver, communicatively coupled to the mobile device;

a first processor, coupled to the first transceiver; and

a signal transformation chip, coupled to the first processor and the telephone plug, the signal transformation chip generating an output signal supported by the mobile device in response to a signal received from the external telephone line, wherein the first processor transmits the output signal to the mobile device through the first transceiver; and

a telephone handset, wherein

a first electromagnetic switch is disposed on the case, wherein the first electromagnetic switch is coupled to the first processor;

a second electromagnetic switch is disposed on a housing of the telephone handset; and

the first processor determines that the telephone handset is on-hook in response to the first electromagnetic switch magnetically coupled to the second electromagnetic switch, and the first processor determines that the telephone handset is off-hook in response to the first electromagnetic switch not magnetically coupled to the second electromagnetic switch, wherein the first processor instructs the mobile device through the first transceiver to execute at least one of starting up, displaying a dial pad, displaying an address book, and displaying a web browser page in response to determining that the telephone handset is off-hook, wherein the first processor instructs the mobile device through the first transceiver to enter a standby mode in response to determining that the telephone handset is on-hook.

2. The communication signal transform device according to claim **1**, wherein the signal transformation chip trans-

forms an input signal from the mobile device into a dual tone multi frequency output signal to transmit the dual tone multi frequency output signal to the external telephone line, and transforms the signal from the external telephone line into the output signal to transmit the output signal to the mobile device, wherein the output signal is one of a digital voice signal and a control command.

3. The communication signal transform device according to claim **2**, wherein the control command instructs the mobile device to display a call ID corresponding to the signal.

4. The communication signal transform device according to claim **1**, wherein

the telephone handset comprises:

a second transceiver, communicatively coupled to the first transceiver;

a microphone, receiving a first voice signal;

a speaker, playing a second voice signal; and

a second processor, coupled to the second transceiver, the microphone and the speaker, wherein the second processor transmits the first voice signal to the first transceiver through the second transceiver, and receives the second voice signal from the first transceiver through the second transceiver.

5. The communication signal transform device according to claim **1**, further comprising:

a third electromagnetic switch, disposed on the case and coupled to the first processor; and

a cover, connected to the case and disposed with a fourth electromagnetic switch, wherein the first processor determines that the cover covers on the exposed portion in response to the third electromagnetic switch magnetically coupled to the fourth electromagnetic switch, and the first processor determines that the cover is opened in response to the third electromagnetic switch not magnetically coupled to the fourth electromagnetic switch.

6. The communication signal transform device according to claim **5**, wherein the first processor instructs the mobile device through the first transceiver to execute at least one of starting up, displaying a dial pad, executing a memo application, executing a photo album application, displaying an address book, displaying a news page, and displaying a web browser page in response to determining that the cover is opened.

7. The communication signal transform device according to claim **5**, wherein a plurality of holes is disposed on the cover such that the cover exposes a portion of the display of the mobile device when covering on the exposed portion.

8. The communication signal transform device according to claim **7**, wherein the first processor instructs the mobile device through the first transceiver to display a dial pad in response to determining that the cover covers on the exposed portion, wherein numbers and symbols on the dial pad are exposed through the holes on the cover.

9. The communication signal transform device according to claim **1**, wherein the case further comprises:

a second transceiver, communicatively coupled to the first transceiver;

a microphone, receiving a first voice signal;

a speaker, playing a second voice signal; and

a second processor, coupled to the second transceiver, the microphone and the speaker, wherein the second processor transmits the first voice signal to the first transceiver through the second transceiver, and receives the second voice signal from the first transceiver through the second transceiver.

10. A communication signal transform method, adapted for transforming a mobile device into a landline telephone, the communication signal transform method comprising:

disposing the mobile device detachably in a case having an exposed portion, and exposing a display of the mobile device from the case through the exposed portion; and

generating an output signal supported by the mobile device in response to a signal received from an external telephone line, and transmitting the output signal to the mobile device,

wherein a first electromagnetic switch is disposed on the case, and a second electromagnetic switch is disposed on a housing of a telephone handset that fits the case, wherein the communication signal transform method further comprises:

determining that the telephone handset is on-hook in response to the first electromagnetic switch magnetically coupled to the second electromagnetic switch;

determining that the telephone handset is off-hook in response to the first electromagnetic switch not magnetically coupled to the second electromagnetic switch,

instructing the mobile device to execute at least one of starting up, displaying a dial pad, displaying an address book, and displaying a web browser page in response to determining that the telephone handset is off-hook, and

instructing the mobile device to enter a standby mode in response to determining that the telephone handset is on-hook.

11. The communication signal transform method according to claim **10**, further comprising:

transforming an input signal from the mobile device into a dual tone multi frequency output signal to transmit the dual tone multi frequency output signal to the external telephone line; and

transforming the signal from the external telephone line into the output signal to transmit the output signal to the mobile device, wherein the output signal is one of a digital voice signal and a control command.

12. The communication signal transform method according to claim **11**, wherein the control command instructs the mobile device to display a call ID corresponding to the signal.

13. The communication signal transform method according to claim **10**, further comprising:

disposing a third electromagnetic switch on the case;

connecting a cover disposed with a fourth electromagnetic switch to the case;

determining that the cover covers on the exposed portion in response to the third electromagnetic switch magnetically coupled to the fourth electromagnetic switch; and

determining that the cover is opened in response to the third electromagnetic switch not magnetically coupled to the fourth electromagnetic switch.

14. The communication signal transform method according to claim **13**, further comprising: instructing the mobile device to execute at least one of starting up, displaying a dial pad, executing a memo application, executing a photo album application, displaying an address book, displaying a news page, and displaying a web browser page in response to determining that the cover is opened.

15. The communication signal transform method according to claim **13**, further comprising:

disposing a plurality of holes on the cover such that the cover exposes a portion of the display of the mobile device when covering on the exposed portion.

16. The communication signal transform method according to claim **15**, further comprising:

instructing the mobile device to display a dial pad in response to determining that the cover covers the exposed portion, wherein numbers and symbols on the dial pad are exposed through the holes on the cover.

17. The communication signal transform method according to claim **10**, further comprising:

receiving a first voice signal by using a microphone on the case;

transforming the first voice signal into a dual tone multi frequency output signal, and transmitting the dual tone multi frequency output signal to the external telephone line;

transforming the signal from the external telephone line into a second voice signal, wherein the signal is a dual tone multi frequency input signal; and

playing the second voice signal by using a speaker on the case.

* * * * *